

of the subject it would have been better to omit these and to have utilised the space so saved in filling up some of the gaps left in the theoretical treatment, and to which we refer later. The same remarks apply to some extent to the sections on the separation of organic compounds, which are valuable in so far as they treat of the law of partition and the distillation of mixtures of miscible and of non-miscible liquids, but much space is taken up by descriptions of working methods unnecessary to the student who has attended an experimental course in the subject, and insufficient for the instruction of the inexperienced. Again, in a book of limited space, why lavish two whole pages on illustrations of a large table carrying a small combustion furnace, with tube and fittings, and of an ordinary type of reflux apparatus! The book could hardly have suffered from the omission of these, together with most of the remaining illustrations, the instructional value of which, for example, of the sketch of the superseded distilling tube of Le Bel and Henninger, or of the large acetylene burner on p. 95, is not always apparent.

Having found fault so far with the introduction, and that chiefly because of its failure to reach the standard of excellence set up by the preface, we must state that the theoretical discussions throughout the remainder of the book are clear and satisfactory, as are also the later portions of the introduction dealing with the calculation of formulæ and molecular weights, the thermochemistry of carbon, and the general properties and classification of the compounds of carbon according to their structure.

Of the 585 pages remaining after the introduction, 317 are devoted to the consideration of the alicyclic compounds and thirty-nine to the cyclic groups intermediate between these and benzene. This, with its derivatives, is described in 175 pages, leaving only fifty-four for the discussion of the heterocyclic compounds, the glucosides, the albuminous substances, and the soluble ferments. As the book contains comparatively little small print and the margins are ample, it follows that some of the groups must be treated in but a scanty manner, if at all, those included under the three last headings being the chief sufferers from this cause. Certainly in the space at his disposal the author gives a surprisingly comprehensive review of the more important of the heterocyclic compounds.

The arrangement of the alicyclic compounds differs in several respects from that to which we are accustomed. The esters appear under the old name of "compound ethers" amongst the ethereal derivatives of the alcohols, whilst we do not make acquaintance with the ketones or the aldehydes until after the description of the monocarboxylic acids and the substances derived from these. A few helpful tables are given showing the principal mono- and di-basic acids with their main physical properties, and of the aldoses with the corresponding penta-hydroxy-acids. The carbohydrates are followed by a succinct account of the derivatives of carbonic acid.

In the course of the chapters on the alicyclic com-

pounds, optical activity and the hypothesis of the asymmetric carbon atom, the dynamics of esterification, the nature and properties of the pseudo-acids, the constitution of the complicated derivatives of cyanogen, and the employment of the inversion of cane sugar in the measurement of the strength of acids, are clearly if briefly explained. Similar concise discussions of the question of the structure of the benzene nucleus—including the arguments in favour of the centric formula, the application of Thiele's hypothesis of partial valencies, and the bearing of the optical properties—and of the constitution of the diazonium salts and the diazotates and their relation to the nitrosamines are to be found in the chapters on the aromatic compounds. We must remark at the same time that there is no mention of several important matters, such as the difficulty of esterifying certain carboxylic acids by boiling with alcohol and an acid, and Victor Meyer's explanation of this on the assumption of the so-called "space interference," nor can we find any account of Gustav Komppa's synthesis of *r*-camphoric acid.

References to the original literature are of great value in all beyond the most elementary text-books, and would have been specially so in a work intended for the use of students otherwise unguided; here such references are entirely wanting. Only occasionally even does the description of a reaction, a synthesis, or a theory suggest its author's name.

The book is provided with a subject index, but not with a table of contents; fortunately, the page-headings are well arranged. Although some portions of the book are decidedly disappointing, on the whole it can hardly fail, if conscientiously read, to broaden the views even of students considerably beyond an elementary stage of knowledge in organic chemistry.

G. Y.

SOME OPINIONS ON TEACHING MECHANICS.

The Teaching of Elementary Mechanics. Discussion which took place at Johannesburg at the British Association Meeting in South Africa on August 29, 1905, in Section A, Prof. Forsyth, President of the Section, in the Chair, together with written criticisms and a paper by C. E. Ashford, M.A. Edited by John Perry. Pp. 74. (London: Macmillan and Co., Ltd., 1906.) Price 2s. net.

THIS little book is another addition to many others comes of Prof. Perry's never-failing activity and energy in trying to improve the teaching of our schools in matters connected with elementary science. At the British Association in Johannesburg last year, Prof. Perry, in the midst of his arduous duties as general treasurer of the association, found time to open a discussion on the teaching of elementary mechanics, and, not content with this, he collected the remarks of all the speakers at the meeting, and specially engaged a "chiel takin' notes" to keep a record of their speeches. He next wrote round to a large number of teachers and others in England,

and if he only received eleven replies it cannot be denied that the writers of these replies fairly represented all sorts and conditions of men, and that the subject has been discussed, (1) in its academic aspect, (2) from the point of view of the experienced school-master, and (3) from the standpoint of the engineer. The book contains a reprint of the recommendations of the Committee of the Mathematical Association on the Teaching of Elementary Mechanics.

What conclusions can the average reader infer from the divergent opinions expressed in this book?

(1) There is a general consensus of opinion that the teaching of mechanics should be more experimental and less dogmatic.

(2) Prof. Perry condemns the use of costly and complicated laboratory apparatus, and considers that more can be learnt from a cheap screw jack and a rusty old pulley than from costly Atwood's machines. In this he is perfectly right.

(3) If the teaching of mechanics is to be made more practical, greater attention should be paid to friction and other resistances which occur in nature. So long as friction is shelved into the background, mechanics cannot be anything but the study of what would happen under impossible conditions.

(4) The advocates of the poundal and the advocates of the slug will never agree.

(5) The academic side does not wish the poundal adopted for practical purposes (p. 13). In examination papers answers are never—well hardly ever—asked for in poundals, and generally a candidate would lose marks by giving the pull of a railway engine in poundals or tons. But the academic teacher strongly objects to swallowing the slug, and not without reason.

(6) The engineering side is trying hard to force the slug down the throat of the academic teacher, its main plan of campaign consisting in attacking the poundal as unit of force.

(7) Both sides seem willing, up to a certain point, to allow beginners to solve elementary problems by the use of Newton's laws, according to which change of motion is proportional—not equal to the impressed force—a method which avoids both the poundal and the slug. But they still cling tenaciously to the modern substitute for Newton's statements.

(8) The engineering side has had to accept the C.G.S. dynamical units, and there seems no reason why schoolboys should not leave the equation $F=ma$ until they learn to work with the metric system.

(9) The universal adoption of the metric system affords the most probable direction for a compromise.

(10) Prof. Perry advocates (p. 61) teaching mechanics through force rather than through mass as the fundamental notion; and yet some remarks seem rather to indicate that he wishes every school-boy to realise that force is the vector time flux of momentum.

(11) Many teachers condemn tons, velos and celos, others strongly advocate them. One critic (p. 55) goes so far as to express regret "that for units of momentum and mass-acceleration we have no suitable

names at all"; but does not the *poundal* meet his requirements when regarded as the unit of *mass-acceleration*? Surely it is the use of this unit for measuring *forces* (by naval engineers and others) that is open to the serious objections raised on p. 64.

(12) The same differences exist in regard to centrifugal force.

We have no wish to reopen controversies on these questions, but we cannot help thinking that if every schoolboy is to know the laws of motion, it is also important that every schoolboy should know a great deal about the laws of the country he lives in. He should also learn something about economics, something about choice and chance, in order that he may not develop into a gambler, some experimental and geometrical optics, and many other things besides, which he does not now learn. That "it must be good for all boys to learn something of measurement and how to use their hands" is a point on which all can agree with Prof. Perry.

G. H. B.

OUR BOOK SHELF.

What Are We? By Leonard Joseph. Pp. xiii+394. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1906.) Price 15s. net.

"THEY say the owl was a baker's daughter. Lord, we know what we are, but know not what we may be." A certain incoherence in Ophelia's words would have prevented us at one time from regarding her as a possible authority on the metaphysical questions raised by the title to this book, but she is soundness, suggestiveness, and lucidity themselves when compared with Mr. Joseph.

Three peculiarities in this pretentious work will strike the observant reader:—(1) Excellent as "Chambers's Encyclopædia" and the paper called *Answers* are in their own place—and Prof. York Powell is said to have thought highly of the latter—we doubt if there are many scientific works of the first rank in this country in which these are paraded in the foot-notes or in the list of books consulted.

(2) Mr. Joseph poses in the opening paragraphs as an orthodox believer whose motto is "Search the Scriptures, watch and pray," but confesses in the end, with much pride, that this is merely a device to secure for his pages a reading from unreasonable and stubborn church-goers. It would have been more tactful to assume that all his readers were reasonable human beings, or that, at any rate, the weight of the arguments adduced would of itself overcome all initial distrust. (3) Mr. Joseph argues soberly—if the term sober can be applied without contempt to one who apparently abhors total abstainers as amongst the most depraved of men—for sexual promiscuity. This is bad; indeed, it is even worse than the unsound physiology that defaces the last page, or than the wealth of padding which surrounds and encompasses what might have received adequate treatment in a sixpenny pamphlet.

The Human Mechanism, its Physiology and Hygiene and the Sanitation of its Surroundings. By Prof. Theodore Hough and Prof. W. T. Sedgwick. Pp. ix+564. (Boston and London: Ginn and Co., 1906.) Price 8s. 6d.

MANY writers of text-books on physiology for the lay public are quite incompetent to act as teachers of their fellow men, because they are unacquainted with the